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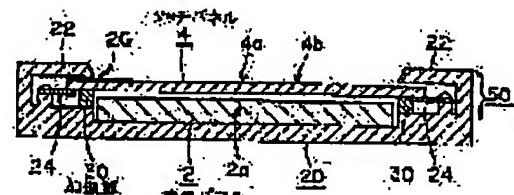
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## (54) THIN SWITCH AND DISPLAY PANEL WITH SWITCH

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To make the best use of the feature of a touch panel so that it can be made extremely thin and at the same time to perceive the operation of a switch part by finger.

**SOLUTION:** This display panel with a switch has structure in which a thin switch 50 is disposed in the upper vicinity of a display panel 2 having an information displaying function. The thin switch 50 is provided with a resistance film touch panel 4 having one or more switch parts 4a in the rear vicinity of a touch surface 4b and capable of being operated by the push-in stroke of nearly zero and a vibration source 30 for vibrating the whole of the touch panel 4 including the touch surface 4b in response to the operation of at least one of the switch parts 4a of the touch panel 4. Therefore, the operation of the switch parts 4a of the touch panel 4 can be perceived by finger with the vibrations of the touch panel 4b.



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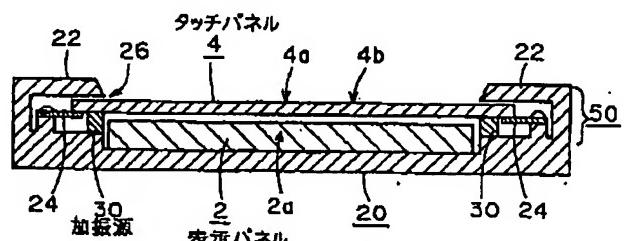
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(54)【発明の名称】薄型スイッチおよびスイッチ付表示パネル

(57)【要約】

【課題】タッチパネルの極めて薄型化が可能であるという特長を生かしつつ、そのスイッチ部を操作したことを目指で感知することができる薄型スイッチおよびスイッチ付表示パネルを提供する。

【解決手段】このスイッチ付表示パネルは、情報表示機能を有する表示パネル2の上方近傍に薄型スイッチ50を配置した構造をしている。薄型スイッチ50は、タッチ面4bの裏近傍に1以上のスイッチ部4aを有していてそれを押し込みストロークがほぼ0で操作可能な抵抗膜式のタッチパネル4と、このタッチパネル4の少なくとも一つのスイッチ部4aが操作されたことに応答して、そのタッチ面4bを含むタッチパネル4全体を振動させる加振源30とを備えている。これによって、タッチパネル4のスイッチ部4aを操作したことを、タッチ面4bの振動によって指で感知することができる。



## 【特許請求の範囲】

【請求項1】 タッチ面の表ないし裏近傍に1以上のスイッチ部を有していてそれを押し込みストロークがほぼ0で操作可能なタッチパネルと、このタッチパネルの少なくとも一つのスイッチ部が操作されたことに応答して当該タッチパネルの少なくともタッチ面を振動させる加振手段とを備えることを特徴とする薄型スイッチ。

【請求項2】 情報表示機能を有する表示パネルと、この表示パネルの上方近傍に配置されたものであって、タッチ面の表ないし裏近傍に1以上のスイッチ部を有していてそれを押し込みストロークがほぼ0で操作可能な透明または半透明のタッチパネルと、このタッチパネルの少なくとも一つのスイッチ部が操作されたことに応答して当該タッチパネルの少なくともタッチ面を振動させる加振手段とを備えることを特徴とするスイッチ付表示パネル。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 この発明は、例えばFA（ファクトリーオートメーション）機器、自動販売機、自動券売機、情報機器、家庭電気製品、医療用の操作機器等に用いられる薄型スイッチおよびそれを用いたスイッチ付表示パネルに関する。

## 【0002】

【従来の技術】 薄型スイッチの典型的なものにタッチパネルがある。タッチパネルは、要約すれば、人がタッチするタッチ面の表ないし裏近傍に1以上のスイッチ部を有していてそれを押し込みストロークがほぼ0で、即ち触れるか軽く押す程度で操作可能なパネル状のスイッチと言うことができる。

【0003】 このようなタッチパネルには、①透明薄板間に上下の透明電極をわずかなスペースをあけて対向させた抵抗膜式（これは透明電極式とも呼ばれる。以下同じ）、②発光素子から出た光が受光素子に入るのを指などで遮断または減衰させる光電式、③超音波発振素子から出た超音波が受振素子に入るのを指などで遮断または減衰させる超音波式、その他静電容量式等がある。

【0004】 このようなタッチパネルは、それ単独で薄型スイッチとして、あるいは、それを情報表示機能を有する表示パネル上に重ねることによってスイッチ付表示パネルとして利用されている。

## 【0005】

【発明が解決しようとする課題】 タッチパネルは、極めて薄型化が可能であるという特長を有しているけれども、上記いずれの方式の場合も、通常のスイッチ機構を有するスイッチと違って、スイッチ部の押し込みストロークがほぼ0であるため、またクリック感を出すことができないため、そのスイッチ部を確かに操作した（典型的にはオンさせた）ということを、指で感知することができない。

スイッチ部を確かに操作したか否かが分からず、不安になる。

【0006】 これを補うために従来は、タッチパネルのスイッチ部を操作した時に、タッチパネルと組み合わせた液晶ディスプレイ等の表示を変化させる方法や、ブザー等の音を出す方法を併用していた。

【0007】 ところが、表示を変化させる方法では、操作者が横を向いているときとか、目の不自由な人である場合には確認することができない。

【0008】 また、音を出す方法では、喧しい場所とか、操作者が耳の不自由な人である場合には確認することができない。また、音が出ると困る場所ではこの音が邪魔になる。

【0009】 やはり、操作した人の指で、スイッチ部を操作したことを感じするのが最も自然で合理的である。

【0010】 そこでこの発明は、タッチパネルの極めて薄型化が可能であるという特長を生かしつつ、そのスイッチ部を操作したことを指で感知することができる薄型スイッチおよびそれを用いたスイッチ付表示パネルを提供することを主たる目的とする。

## 【0011】

【課題を解決するための手段】 この発明の薄型スイッチは、タッチ面の表ないし裏近傍に1以上のスイッチ部を有していてそれを押し込みストロークがほぼ0で操作可能なタッチパネルと、このタッチパネルの少なくとも一つのスイッチ部が操作されたことに応答して当該タッチパネルの少なくともタッチ面を振動させる加振手段とを備えることを特徴とする。

【0012】 また、この発明のスイッチ付表示パネルは、情報表示機能を有する表示パネルと、この表示パネルの上方近傍に配置されたものであって、タッチ面の表ないし裏近傍に1以上のスイッチ部を有していてそれを押し込みストロークがほぼ0で操作可能な透明または半透明のタッチパネルと、このタッチパネルの少なくとも一つのスイッチ部が操作されたことに応答して当該タッチパネルの少なくともタッチ面を振動させる加振手段とを備えることを特徴とする。

【0013】 タッチ面とは、タッチパネルの人がタッチする面のことである。タッチ面の表ないし裏近傍とは、タッチ面の表面そのもの、タッチ面の表近傍またはタッチ面の裏近傍のいずれでも良いことを意味する。スイッチ部の操作とは、スイッチ部の状態を変化させることを意味し、典型的にはオンさせることである。

【0014】 上記薄型スイッチによれば、そのタッチパネルのスイッチ部を操作すると、それに応答して、加振手段によって当該タッチパネルの少なくともタッチ面が振動させられ、その振動が操作した人の指に伝わる。従って、スイッチ部を操作したことを、タッチ面の振動によって指で感知することができる。

は、タッチパネルを用いた上記のような薄型スイッチを表示パネルの上方近傍に配置した構造をしているので、上記薄型スイッチと同様の作用によって、タッチパネルのスイッチ部を操作したことをタッチ面の振動によって指で感知することができる。しかも、タッチパネルと表示パネルとの間を接近させることができ、それによってタッチパネルのすぐ近くに表示パネルの表示内容が表示されることになるので、その表示内容が非常に見易い。

## 【0016】

【発明の実施の形態】図1は、抵抗膜式のタッチパネルを備える薄型スイッチを用いたスイッチ付表示パネルの実施例を示す断面図である。この実施例では、タッチパネル4のタッチ面4bの裏近傍に1以上のスイッチ部4aが形成されている。

【0017】この実施例のスイッチ付表示パネルは、ケース20内の底部に、情報表示機能を有する表示パネル2を配置すると共に、この表示パネル2の上方近傍に薄型スイッチ50を配置した構造をしている。

【0018】表示パネル2は、要は情報表示機能を有しておれば良く、表示する情報が固定情報であるか可変情報であるか、自発光であるか否か、バックライト等を有しているか否か、等は問わない。例えば、この表示パネル2は、典型的には液晶ディスプレイであるが、その他、EL(エレクトロルミネッセント)ディスプレイ、プラズマディスプレイ、CRT、LEDアレイ、情報を表示する記録板や液晶シャッターとそれを照らす発光体や反射板とを組み合わせたもの、更には情報を記載した單なるシートやプレート等でも良い。表示パネル2が例えばシートやプレート等のように極く薄いもの場合は、それをタッチパネル4の裏面に取り付けても良い。

【0019】ケース20の構造は、表示パネル2の種類等に応じて適宜選定すれば良い。また、薄型スイッチ50用のケースと表示パネル2用のケースとを別にしても良い。

【0020】表示パネル2には、この実施例では、薄型スイッチ50を構成するタッチパネル4の各スイッチ部4aの下部付近に、当該スイッチ部4aの操作によって選択される内容を表示する表示領域2aがそれぞれ形成されている。従って、所望のスイッチ部4aの選択・操作が容易になる。

【0021】薄型スイッチ50は、この実施例では、抵抗膜式のタッチパネル4と、このタッチパネル4の少なくとも一つのスイッチ部4aが操作されたことに応答して、表面のタッチ面4bを含むタッチパネル4全体を振動させる加振手段を構成する加振源30とを備えている。

【0022】このタッチパネル4は、硬質基板の表面近傍に、外部から軽く(即ちストロークがほぼ0で)押されることによってオンする1以上のスイッチ部4aを設

ある。より具体例を示せば、例えば図2に示す例のように、タッチパネル4は、上面に透明電極8が形成された透明の硬質基板6上に、複数の開口部12を有する透明薄板10を重ね、更にその上に、下面に透明電極18が形成された透明薄板16を重ねて成る。透明電極8および18は、互いに直交する複数のストライプ状の電極の場合もあるし、一方の電極、例えば透明電極18が複数の電極であり、他方の電極、例えば透明電極8が共通電極の場合もある。透明薄板16は、薄板だから可撓性がある。

【0023】下に硬質基板6を用いているのは、タッチパネル4全体を表示パネル2から浮かせているのでその平板形状を保つためと、加振源30からの振動をタッチパネル4全体に伝えやすくするためである。この硬質基板6は、例えば透明アクリル板、透明ガラス板等から成る。もっとも、透明シートを用いて形成した比較的柔らかいタッチパネルを、他の硬質の基板上(この例の場合には透明の硬質基板上)に重ねても良い。また、タッチパネル4専用の硬質基板を設ける代わりに、表示パネル2を硬質のものにしてそれに上記硬質基板を兼ねさせても良い。

【0024】このタッチパネル4では、その表面が、より具体的にはその透明薄板16の表面が、人がタッチするタッチ面4bであり、その裏側近傍にある各開口部12の部分にスイッチ部4aが形成されており、透明薄板16側から所望の開口部12の部分を軽く押すと、押された部分の透明薄板16および透明電極18が撓んで、その透明電極18は開口部12を通して下の透明電極8と接触して電気的にオンする。但し、各スイッチ部4aの大きさ、形状、位置、数等は任意であり、また、小さなスイッチ部4aを複数個まとめて(即ち電気的に並列接続して)一つのスイッチ部として使用する場合もある。

【0025】図1を再び参照して、このタッチパネル4の周縁部をケース20に直接固定しても良いけれども、この実施例では、タッチパネル4全体を振動させやすくするために、タッチパネル4をケース20から浮かせてその周縁部を複数個の弾性体24を介してケース20から支持している。この弾性体24は、例えばタッチパネル4の四隅付近に取り付けている。各弾性体24は、例えば、図1に示す例のような平板状の板ばねでも良いけれども、図4に示す例のような波板状の板ばねにすれば、タッチパネル4を一層振動させやすくなる。また、各弾性体24は、コイルばねでも良いし、その他、ゴムやスポンジ等でも良い。

【0026】この例では、ケース20の周縁部22がタッチパネル4の周縁部上に被さっており、この周縁部22とタッチパネル4とを直接接觸させても良いけれども、この実施例ではタッチパネル4を振動させやすくす

ける場合はそこに、例えば図5に示す例のように、防水・防塵機能を有する弾性体42を設けても良い。この弾性体42は、例えばスポンジ、ゴム膜等である。タッチパネル4は穴や隙間がなく元々防水・防塵機能を有しているので、上記のような弾性体42を設ければ、タッチパネル4の振動を容易にしつつ、簡単にこの薄型スイッチ50全体を防水・防塵構造にすることができる。

【0027】上記タッチパネル4の周縁部とケース20との間に、この例ではタッチ面4bを含むタッチパネル4全体を振動させる加振源30を設けている。もっとも、真に振動させる必要があるのはタッチ面4bであるが、この例ではタッチパネル4の表面がそのままタッチ面4bであるので、タッチパネル4全体を振動させることにしているだけであり、タッチパネル4全体を振動させるというのは必須ではない。この加振源30は、1個でも良いけれども、複数個にしてそれをタッチパネル4の周縁部に分散して配置すれば、タッチパネル4全体をより一様に振動させることができる。

【0028】各加振源30は、この例では一例として、圧電振動子である。圧電振動子は、周知のように、圧電基板の両面に設けた電極間に交流電圧を印加することによって圧電基板を振動させる素子である。この圧電振動子とほぼ同様の構造をしたものに圧電アクチュエータがあり、それをこの加振源30に用いても良い。

【0029】加振源30によってタッチパネル4を振動させる周波数は、あまり低いと指に伝わる感触がゴツゴツした荒いものになり、あまり高いと指がくすぐったくなるので、50Hz～150Hzの範囲内にするのが好ましく、その内でも80Hz～130Hzの範囲内が特に好ましい。他の実施例においても同様である。

【0030】各加振源30を電気的に駆動する駆動回路の一例を図3に示す。

【0031】タッチパネル4は、この例ではm行の透明電極8と、n列の透明電極18とを有しており(m、nは1以上の整数)、それらの各交点が前述したスイッチ部4aである。これらの各透明電極8、18は、押圧操作の行われたスイッチ部4aを特定する外部の回路(図示省略)へ接続するために引き出されると共に、検出回路52に接続されている。

【0032】検出回路52は、タッチパネル4の少なくとも一つのスイッチ部4aが操作されたことを検出して、当該スイッチ部4aが操作されている間ずっと所定レベルの、例えば高レベルの検出信号Sを出力する。この検出回路52は、例えば、1～m行の透明電極8が入力部に接続された第1のオア回路と、1～n列の透明電極18が入力部に接続された第2のオア回路と、両オア回路からの出力のアンドを求めるアンド回路とを用いる等して、公知の技術で構成することができる。

【0033】この検出回路52からの検出信号Sは交流

信号Sに応答して、それが与えられている間、各加振源30に一括して交流電圧を供給してそれらを駆動する。この交流発振器54と加振源30との間に、必要に応じて、增幅回路を設けても良い。この交流発振器54の出力の周波数と加振源30の振動の周波数とは基本的には互いに等しいので、この交流発振器54の出力の周波数は、前述したように、50Hz～150Hzの範囲内にするのが好ましく、その内でも80Hz～130Hzの範囲内が特に好ましい。

【0034】この検出回路52および交流発振器54は、前述したケース20内に収納する等してこの実施例の薄型スイッチ50に付属させても良いし、そのようにせずに、この薄型スイッチ50が接続される相手側の機器内に収納したり、そこに設けられた回路やマイコン等を利用して構成しても良い。後述する検出回路92および108についても同様である。

【0035】図1に示した薄型スイッチ50の動作を説明すると、タッチパネル4の任意の一つのスイッチ部4aを押してそれをオンさせると、それが検出回路52によって検出されてそこから検出信号Sが出力され、それに応じて交流発振器54から各加振源30に交流電圧が供給されて各加振源30が振動し、それによってタッチ面4bを含むタッチパネル4全体が振動させられる。そしてこのタッチパネル4の振動が操作した人の指に伝わる。従って、スイッチ部4aを操作したことを、その操作した指で感知することができる。その結果、操作した人に安心感を与えることができる。

【0036】タッチパネル4のスイッチ部4aの押圧操作を止めると、当該スイッチ部4aは自力でオフし、それに応答して検出回路52からの検出信号Sの出力および交流発振器54からの交流電圧の出力が止み、タッチパネル4の振動は止まる。

【0037】このように、この薄型スイッチ50では、操作した人の指で、タッチパネル4の所望のスイッチ部4aを操作した(典型的にはオンさせた)ことを感知することができるので、最も自然で合理的である。従つて、従来例の表示パネルの表示を変化させる方法と違って、操作者が横を向いているときや、目の不自由な人である場合にも確実に感知することができる。また、従来例の音を出す方法と違って、喧しい場所とか、操作者が耳の不自由な人である場合にも確実に感知することができる。また、音が出ると困る場所でも何ら支障なく使用することができる。

【0038】また、このような薄型スイッチ50を用いた上記スイッチ付表示パネルは、タッチパネル4と表示パネル2との間を接近させることができ、それによってタッチパネル4のすぐ近くに表示パネル2の表示内容が表示されることになるので、薄型スイッチ50の上記のような効果に加えて、表示パネル2の表示内容が非常に

【0039】各加振源30は、上述した圧電振動子や圧電アクチュエータ以外のもので構成しても良い。後述する他の実施例においても同様である。

【0040】例えば、図4に示す例のように、鉄心34にコイル36を巻いた電磁石32と、それに隙間をあけて対向するようにタッチパネル4に取り付けた永久磁石38とで加振源30を構成しても良い。この電磁石32に前述した交流発振器54から交流電流を供給する。それによって鉄心34の磁極にはN、Sが交互に発生し、それに対向する永久磁石38を吸引または反発し、それによってタッチパネル4を振動させることができる。鉄心34の磁極は一つでも良く、その場合はそれに永久磁石38のN極またはS極を対向させれば良い。永久磁石38の代わりに鉄板等の強磁性体を用いても良いけれども、永久磁石38を用いる方が、その磁力をも利用することができるので、加振力はより大きくなる。換言すれば、交流発振器54の出力を小さくして省電力化を図ることができる。

【0041】加振源30は、タッチパネル4に接続されたブランジャーと、それを吸引するコイル等を有する電磁ソレノイドで構成しても良い。この電磁ソレノイドに前述した交流発振器54から交流電流を供給する。それによってブランジャーが振動して、タッチパネル4を振動させることができる。

【0042】加振源30は、回転軸に偏心した重りを付けていて、モータそのものが振動する振動モータで構成しても良い。その場合は、前述した交流発振器54の代わりに、直流電源、または検出信号Sを増幅する增幅回路を設ければ良い。この振動モータをタッチパネル4に当接または取り付けておき、それを回転させることによって、タッチパネル4を振動させることができる。

【0043】なお、タッチパネル4は、上記実施例の場合は、下に配置した表示パネル2と組み合わせるために前述したように透明のものとしたが、表示パネル2の表示内容等によっては、必ずしも透明である必要はなく、半透明であっても良く、要は下の表示パネル2からの光が透過できれば良い。

【0044】また、上記薄型スイッチ50は、表示パネル2上に重ねずに使用することもでき、例えば薄型スイッチ50を表示パネル2とは別個に単独で、あるいは他の機器等と組み合わせて使用することもでき、その場合は、下の表示パネル2からの光を透過させる必要はないので、タッチパネル4は透明または半透明である必要はなく、不透明でも良い。その場合、スイッチ部4aの識別等のために、必要に応じて、タッチパネル4の表面に文字や記号等を記入、刻印、貼付する等しても良い。後述する他の実施例においても同様である。

【0045】ところで、タッチパネルは、上記のような抵抗膜式のタッチパネル4の他に、発光素子から出た光

タッチパネル、または、超音波発振素子から出た超音波が受振素子に入るのを断続または減衰させる超音波式のタッチパネルでも良い。そこで次に、光電式のタッチパネルまたは超音波式のタッチパネルを用いた実施例を説明する。但し、先の実施例と同様の部分は重複説明を省略し、先の実施例との相違点を主体に説明する。

【0046】図6は、タッチパネル114が光電式の場合の例を部分的に示す断面図であり、タッチパネル114より下の部分は先の実施例と同様であるのでここでは図示を省略している。この実施例では、タッチパネル114のタッチ面114bの表近傍に1以上のスイッチ部114aが形成されている。

【0047】タッチパネル114は、図7も参照して、光86を出力する複数の発光素子84および当該光86を受けてそれを電気信号に変換する複数の受光素子90をケース20の周縁部22内に縦横に相対向させて配置し、硬質基板82の表面近傍の空間に、マトリックス状の光路88を形成した構成をしている。二つの光路88の交点付近が、それぞれスイッチ部114aとなってい

20 20 る。マトリックス配置する光路88の数は、 $m \times n$  ( $m, n$ は1以上の整数)で任意である。

【0048】硬質基板82は、例えば透明または半透明のガラス板またはアクリル板から成る。各発光素子84は、例えばLED、半導体レーザ等である。各受光素子90は、例えばホトダイオード、ホトトランジスタ等である。この硬質基板82とケース20の周縁部22との間に隙間をあけるか否か、またはそこに防水・防塵機能を有する弹性体を設けるか否かは、先の実施例の場合と同様である。

【0049】各発光素子84から出力する光86は、赤外光が人目に付かないで好ましいが、もちろん可視光でも良い。また、各発光素子84を発光させる方式は、常時発光させておく方式でも良いし、マイコン等を利用して順番に発光させる方式（これは順次発光方式またはスキャニング方式とも呼ばれる）でも良い。このマイコン等は、例えば、次に説明する検出回路92を構成するものと兼用しても良い。

【0050】縦横の各受光素子90には、この例では図7に示すように、各受光素子90からの信号に応答して、光量の低下した光路88の交点の位置（座標）を検出する、即ち操作の行われたスイッチ部114aを特定してその位置を表す位置信号Pを出力する機能と、少なくとも一つのスイッチ部114aが操作されたことを検出して前述したような検出信号Sを出力する機能とを有する検出回路92が接続されている。交流発振器54以降は前述した実施例の場合と同様であり、その作用等の説明は省略する。

【0051】この実施例では、硬質基板82の表面が、人がタッチするタッチ面114bになっており、このタ

加振源30によって振動させる。即ち、タッチ面114bに指でタッチして光路88を指で遮って任意のスイッチ部114aを操作すると、それが検出回路92によって検出され、それに応答して交流発振器54によって加振源30が駆動されて硬質基板82が振動し、それが指に伝わる。従って、スイッチ部114aを操作したことを、その操作した指で感知することができる。

【0052】なお、硬質基板82は、この実施例ではタッチ面114bを形成するのが主な機能であるので、下に硬質の表示パネル2(図1参照)を配置している場合は、その表示パネル2に上記硬質基板を兼ねさせても良い。即ち、硬質基板82を省略して、表示パネル2の表面をタッチ面としても良い。その場合は、この表示パネル2の少なくとも表面を加振源30によって振動させれば良い。

【0053】図8は、タッチパネル124が超音波式の場合の例を部分的に示す断面図であり、タッチパネル124より下の部分は先の実施例の場合と同様であるのでここでは図示を省略している。この実施例では、タッチパネル124のタッチ面124bの表面そのものに1以上のスイッチ部124aが形成されている。

【0054】このタッチパネル124は、例えば米国特許第5,177,327号に記載されているタッチパネルと同様の技術思想に基づくものである。

【0055】即ちこのタッチパネル124は、図9も参照して、超音波100を出力する複数の発振素子96および当該超音波100'を受けてそれを電気信号に変換する複数の受振素子106を硬質基板94の周縁部の表面に縦横に相対向させて配置し、硬質基板94の表面に、マトリックス状の超音波経路102を形成した構成をしている。二つの超音波経路102の交点付近が、それぞれスイッチ部124aとなっている。この場合、超音波100は指向性が極めて高いから、一つの超音波経路102を伝播する超音波100が隣の超音波経路102に入つて干渉する恐れは通常はない。マトリックス配置する超音波経路102の数は、m×n(m、nは1以上の整数)で任意である。

【0056】硬質基板94は、例えば透明または半透明のガラス基板である。

【0057】超音波100は、この例では弾性表面波であり、発振素子96からの超音波100は導波路98を経由して基板94の表面に導かれ、かつ基板94の表面の超音波100は導波路104を経由して受振素子106に導かれる。各発振素子96および各受振素子106は、例えば圧電振動子である。これらは、この実施例ではケース20の周縁部22内の空間部に納めている。このケース20の周縁部22と基板94との間に隙間をあけるか否か、またはそこに防水・防塵機能を有する弹性体を設けるか否かは、先の実施例の場合と同様である。

図9に示すように、各受振素子106からの信号に応答して、超音波100が減衰した超音波経路102の交点の位置(座標)を検出する、即ち操作の行われたスイッチ部124aを特定してその位置を表す位置信号Pを出力する機能と、少なくとも一つのスイッチ部124aが操作されたことを検出して前述したような検出信号Sを出力する機能とを有する検出回路108が接続されている。交流発振器54以降は前述した実施例の場合と同様であり、その作用等の説明は省力する。

【0059】この実施例では、硬質基板94の表面が、人がタッチするタッチ面124bになっており、このタッチ面124bを含む硬質基板94全体を前述した加振源30によって振動させる。即ち、タッチ面124bに指でタッチして超音波100を指で吸収して任意のスイッチ部124aを操作すると、それが検出回路108によって検出され、それに応答して交流発振器54によって加振源30が駆動されて硬質基板94が振動し、それが指に伝わる。従って、スイッチ部124aを操作したことを、その操作した指で感知することができる。

【0060】なお、超音波100として、上記のような弾性表面波の代わりに、硬質基板94の内部を伝播するねじれ波を利用しても良い。その場合、硬質基板94の相対向する端面に発振素子96および受振素子106を取り付ける。この方式は内面導波形とも呼ばれている。この方式の場合は、硬質基板94の表面のタッチ面124bの裏近傍に1以上の前述したようなスイッチ部124aが形成されていると考えることができる。

【0061】加振源30によるタッチ面の加振方向は、上記実施例ではいずれもタッチ面の上下方向としたが、それに限定されるものではなく、その他の方向、例えばタッチ面に沿う方向等でも良く、要はタッチ面が振動すれば良い。

【0062】上述した各方式のタッチパネルの表面に、例えば図10に示す例のように、それらのタッチパネルのスイッチ部に対応する部分に貫通穴134を有する透明薄板132を重ねておいても良く、そのようにすれば、貫通穴134の部分に生じるわずかな段差によって指の位置決めが行えるので、スイッチ部への指の位置決めが容易かつ確実になる。この透明薄板132に、貫通穴134の代わりに、貫通はしていないけれどもそこが薄くなつて段差を有する部分を設けておいても良く、そのようにしても上記と同様の効果が得られる。

### 【0063】

【発明の効果】この発明は、上記のとおり構成されているので、次のような効果を奏する。

【0064】請求項1記載の薄型スイッチによれば、タッチパネルに上記のような加振手段を組み合わせたので、タッチパネルのスイッチ部を操作したことを、タッチパネルのタッチ面の振動によって指で感知することが

るという特長を生かしつつ、そのスイッチ部を操作したことを指で感知することができる。その結果、操作した人に安心感を与えることができる。

【0065】このようにこの薄型スイッチによれば、操作した人の指でタッチパネルのスイッチ部を操作したことを感じるので、最も自然で合理的である。従って、従来例の表示パネルの表示を変化させる方法と違って、操作者が横を向いているときや、目の不自由な人である場合にも確実に感知することができる。また、従来例の音を出す方法と違って、喧しい場所とか、操作者が耳の不自由な人である場合にも確実に感知することができる。また、音が出ると困る場所でも何ら支障なく使用することができる。

【0066】請求項2記載のスイッチ付表示パネルは、タッチパネルを用いた請求項1記載のような薄型スイッチを表示パネルの上方近傍に配置した構造をしているので、タッチパネルのスイッチ部を操作したことを、タッチ面の振動によって指で感知することができる。従つて、操作した人に安心感を与えることができる等の、請求項1記載の薄型スイッチと同様の効果を奏する。

【0067】しかも、タッチパネルと表示パネルとの間を接近させることができ、それによってタッチパネルのすぐ近くに表示パネルの表示内容が表示されることになるので、その表示内容が非常に見易いという効果も奏する。

#### 【図面の簡単な説明】

【図1】抵抗膜式のタッチパネルを備える薄型スイッチを用いたスイッチ付表示パネルの実施例を示す断面図である。

【図2】抵抗膜式のタッチパネルの一例を分解して示す断面図である。

【図3】加振源を電気的に駆動する回路の一例を示す図

である。

【図4】加振源に電磁石を用いた例を拡大して部分的に示す断面図である。

【図5】防水・防塵機能を有する弹性体を設けた例を拡大して部分的に示す断面図である。

【図6】タッチパネルが光電式の場合の例を部分的に示す断面図である。

【図7】図6のタッチパネルを、加振源を電気的に駆動する回路と共に示す平面図である。

【図8】タッチパネルが超音波式の場合の例を部分的に示す断面図である。

【図9】図8のタッチパネルを、加振源を電気的に駆動する回路と共に示す平面図である。

【図10】タッチパネル上に重ねる透明薄板の一例を示す平面図である。

#### 【符号の説明】

2 表示パネル

4 抵抗膜式のタッチパネル

4a スイッチ部

20 4b タッチ面

30 加振源

32 電磁石

38 永久磁石

50 薄型スイッチ

52 検出回路

54 交流発振器

114 光電式のタッチパネル

114a スイッチ部

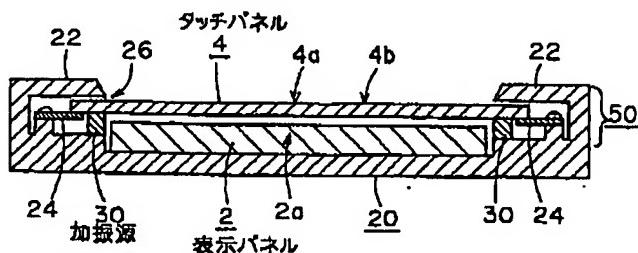
114b タッチ面

30 124 超音波式のタッチパネル

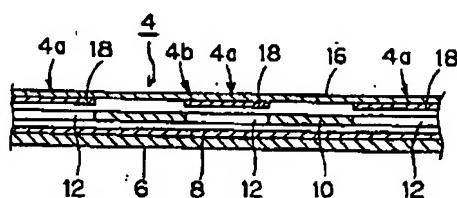
124a スイッチ部

124b タッチ面

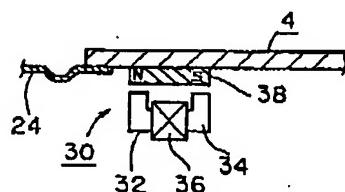
【図1】



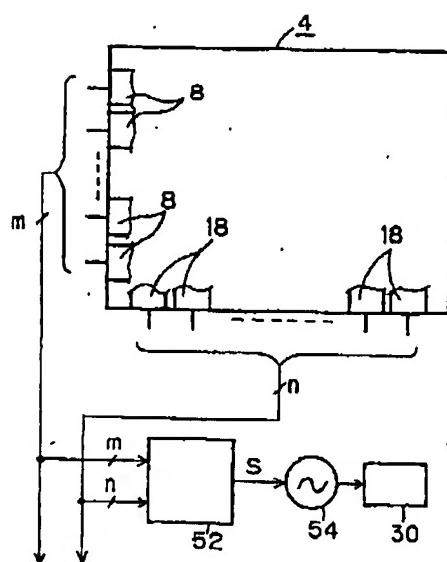
【図2】



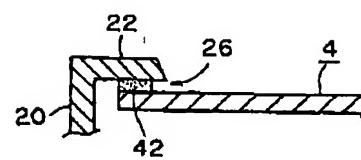
【図4】



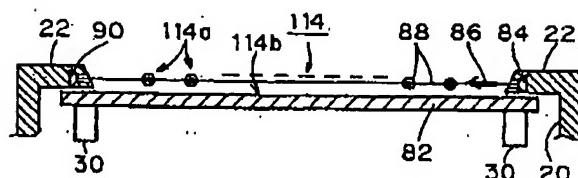
【図3】



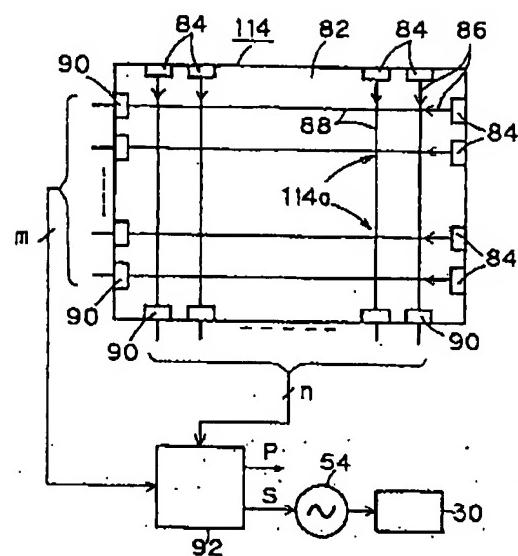
【図5】



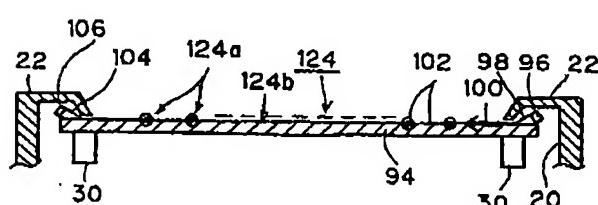
【図6】



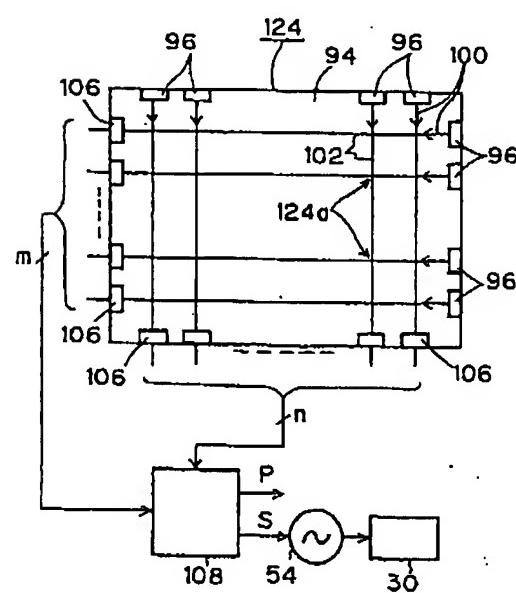
【図7】



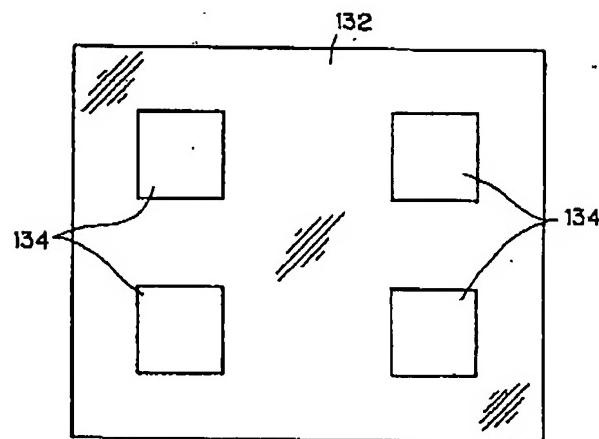
【図8】



【図9】



【図10】



# PATENT ABSTRACTS OF JAPAN

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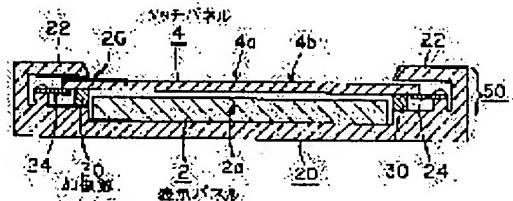
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## (54) THIN SWITCH AND DISPLAY PANEL WITH SWITCH

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To make the best use of the feature of a touch panel so that it can be made extremely thin and at the same time to perceive the operation of a switch part by finger.

**SOLUTION:** This display panel with a switch has structure in which a thin switch 50 is disposed in the upper vicinity of a display panel 2 having an information displaying function. The thin switch 50 is provided with a resistance film touch panel 4 having one or more switch parts 4a in the rear vicinity of a touch surface 4b and capable of being operated by the push-in stroke of nearly zero and a vibration source 30 for vibrating the whole of the touch panel 4 including the touch surface 4b in response to the operation of at least one of the switch parts 4a of the touch panel 4. Therefore, the operation of the switch parts 4a of the touch panel 4 can be perceived by finger with the vibrations of the touch panel 4b.



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**TECHNICAL FIELD**

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[Field of the Invention] This invention relates to the thin switch used for for example, FA (factory automation) device, an automatic vending machine, an automatic ticket vending machine, information machines and equipment, a home electrical-and-electric-equipment product, the actuation device of medical application, etc., and the display panel with a switch using it.

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**PRIOR ART**

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[Description of the Prior Art] A touch panel is one of the typical things of a thin switch. If it summarizes, the touch panel has [ near / which people touch / the table of a touch side thru/or near the flesh side ] the one or more switch sections, pushes it in, and a stroke is about 0, namely, it can say it as the switch of the shape of whether it touches and a panel operational with extent pushed lightly.

[0003] The resistance film type which opened few tooth spaces for the up-and-down transparent electrode between \*\* transparency sheet metal, and was made to counter such a touch panel (this is also called a transparent electrode type.) There are a photoelectrical type which intercepts or attenuates with a finger etc. that the light which came out of the same \*\* light emitting device below goes into a photo detector, an ultrasonic type which intercepts or attenuates with a finger etc. that the supersonic wave which came out of \*\* supersonic-wave oscillation component goes into a \*\*\*\* component, other electrostatic-capacity types, etc.

[0004] Such a touch panel is used as a display panel with a switch by piling it as a thin switch up by independent [ its ] on the display panel which has an information-display function.

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

**[Drawing 1]** It is the sectional view showing the example of the display panel with a switch using a thin switch equipped with the touch panel of a resistance film type.

**[Drawing 2]** It is the sectional view decomposing and showing an example of the touch panel of a resistance film type.

**[Drawing 3]** It is drawing showing an example of a circuit which drives the source of excitation electrically.

**[Drawing 4]** It is the sectional view in which expanding the example which used the electromagnet for the source of excitation, and showing it partially.

**[Drawing 5]** It is the sectional view in which expanding the example which prepared the elastic body which has waterproofing and a protection-against-dust function, and showing it partially.

**[Drawing 6]** It is the sectional view showing partially an example in case a touch panel is a photoelectrical type.

**[Drawing 7]** It is the top view showing the touch panel of **drawing 6** with the circuit which drives the source of excitation electrically.

**[Drawing 8]** It is the sectional view showing partially an example in case a touch panel is an ultrasonic type.

**[Drawing 9]** It is the top view showing the touch panel of **drawing 8** with the circuit which drives the source of excitation electrically.

**[Drawing 10]** It is the top view showing an example of the transparence sheet metal piled up on a touch panel.

**[Description of Notations]**

2 Display Panel

4 Touch Panel of Resistance Film Type

4a Switch section

4b Touch side

30 Source of Excitation

32 Electromagnet

38 Permanent Magnet

50 Thin Switch

52 Detector

54 Alternating Current Oscillator

114 Photoelectrical-type Touch Panel

114a Switch section

114b Touch side

124 Ultrasonic-type Touch Panel

124a Switch section

124b Touch side

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**TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention] the touch panel has the features that thin-shape-izing is very possible -- although kicked -- the above -- since the pushing stroke of the switch section was about 0, and since a feeling of a click cannot be taken out unlike the switch which has the usual switch mechanism, in [ any ] the method, surely the switch section operated -- \*\* (it made turn on typically) -- there is a problem that where of what is said cannot sense with a finger. Then, it does not know whether, surely the person who operated it operated the switch section, but he becomes uneasy.

[0006] In order to compensate this, when the switch section of a touch panel was operated conventionally, the approach of changing the display of the liquid crystal display combined with the touch panel, and the approach of making the sound of a buzzer etc. were used together.

[0007] However, by the approach of changing a display, when the operator has turned to width, when it is a visually handicapped person, it cannot check.

[0008] moreover -- the approach of making a sound -- noisiness -- when a location and an operator are persons hard of hearing, it cannot check. Moreover, in the location which will be troubled if a sound comes out, this sound becomes obstructive.

[0009] It is most natural to sense to have operated the switch section too with the finger of the person who operated it, and it is rational.

[0010] Then, this invention sets it as the main purpose to offer the thin switch which can sense having operated that switch section with a finger, and the display panel with a switch using it, employing efficiently the features of a touch panel that thin-shape-izing is very possible.

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**EFFECT OF THE INVENTION**

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[Effect of the Invention] Since this invention is constituted as above-mentioned, it does the following effectiveness so.

[0064] According to the thin switch according to claim 1, since the above excitation means were combined with the touch panel, it can sense having operated the switch section of a touch panel with a finger by vibration of the touch side of a touch panel. That is, it can sense having operated the switch section with a finger, employing efficiently the features of a touch panel that thin-shape-izing is very possible. Consequently, sense of security can be given to the person who operated it.

[0065] Thus, since it can sense having operated the switch section of a touch panel with the finger of the person who operated it according to this thin switch, it is the most natural and rational. Therefore, unlike the approach of changing the display of the display panel of the conventional example, when the operator has turned to width, also when it is a visually handicapped person, it can sense certainly. moreover, the approach of making the sound of the conventional example -- being different -- noisiness -- also when a location and an operator are persons hard of hearing, it can sense certainly. Moreover, it can be used convenient at all also in the location which will be troubled if a sound comes out.

[0066] Since the display panel with a switch according to claim 2 is having structure which has arranged the thin switch [ like ] according to claim 1 which used the touch panel near the upper part of a display panel, it can sense having operated the switch section of a touch panel with a finger by vibration of a touch side. Therefore, the same effectiveness as the thin switch of being able to give sense of security to the person who operated it according to claim 1 is done so.

[0067] And since between a touch panel and display panels can be made to approach and the contents of a display of a display panel will be displayed by it immediately near the touch panel, the effectiveness that the contents of a display are very legible also does so.

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**MEANS**

[Means for Solving the Problem] The thin switch of this invention is characterized by answering that have the one or more switch sections the table of a touch side thru/or near the flesh side, pushed it in, and at least one switch section of a touch panel operational with about 0 in a stroke and this touch panel was operated, and having an excitation means of the touch panel concerned to vibrate a touch side at least.

[0012] Moreover, the display panel with which the display panel with a switch of this invention has an information-display function, It is arranged near the upper part of this display panel, has the one or more switch sections the table of a touch side thru/or near the flesh side, and it is pushed in. Transparency operational with about 0 in a stroke, or a translucent touch panel, It is characterized by answering that at least one switch section of this touch panel was operated, and having an excitation means of the touch panel concerned to vibrate a touch side at least.

[0013] A touch side is a field which the man of a touch panel touches. It means that any near the flesh side of a touch side the front face of a touch side itself and near front [ of a touch side ] are sufficient the table of a touch side thru/or near the flesh side. Actuation of the switch section is meaning changing the condition of the switch section and making it turn on typically.

[0014] According to the above-mentioned thin switch, if the switch section of the touch panel is operated, it will be answered and it will get across to the finger of the person whom the touch side was vibrated at least and the vibration operated of the touch panel concerned with an excitation means. Therefore, it can sense having operated the switch section with a finger by vibration of a touch side.

[0015] Substantially, since the above-mentioned display panel with a switch is having structure which has arranged the above thin switches which used the touch panel near the upper part of a display panel, it can sense having operated the switch section of a touch panel according to the same operation as the above-mentioned thin switch with a finger by vibration of a touch side. And since between a touch panel and display panels can be made to approach and the contents of a display of a display panel will be displayed by it immediately near the touch panel, the contents of a display are very legible.

[0016]

[Embodiment of the Invention] Drawing 1 is the sectional view showing the example of the display panel with a switch using a thin switch equipped with the touch panel of a resistance film type. In this example, one or more switch section 4a is formed near the flesh side of touch side 4b of a touch panel 4.

[0017] The display panel with a switch of this example is making it structure which has arranged the thin switch 50 near the upper part of this display panel 2 while arranging the display panel 2 which has an information-display function at the pars basilaris ossis occipitalis within a case 20.

[0018] A display panel 2 does not ask whether the information to display is a constant, or it is adjustable information, or is spontaneous light and whether it has the back light etc. that what is necessary is just to have the information-display function in short. For example, although this display panel 2 is a liquid crystal display typically, EL (electroluminescent) display, a plasma display, CRT, an LED array, the thing that combined the emitter which illuminates the imprinting plate and liquid crystal shutter which display information, and it, and the reflecting plate, a mere sheet, a mere plate which indicated

information further, etc. are sufficient as it. a display panel 2 -- for example, a sheet, a plate, etc. -- like - - \*\*\*\* -- although it is thin, a case may attach it in the rear face of a touch panel 4.

[0019] What is necessary is just to select the structure of a case 20 suitably according to the class of display panel 2 etc. Moreover, it is good even if another in the case for thin switch 50, and the case for display-panel 2.

[0020] In this example, viewing-area 2a which displays the contents chosen near the lower part of each switch section 4a of the touch panel 4 which constitutes the thin switch 50 by actuation of the switch section 4a concerned is formed in the display panel 2, respectively. Therefore, selection and actuation of desired switch section 4a become easy.

[0021] In this example, the thin switch 50 answered that at least one switch section 4a of the touch panel 4 of a resistance film type and this touch panel 4 was operated, and is equipped with the source 30 of excitation which constitutes an excitation means to vibrate the touch panel 4 whole containing surface touch side 4b.

[0022] one or more switch section 4a turned on by pushing this touch panel 4 by about 0 namely, a stroke -- lightly from the outside near the front face of a hard substrate -- preparing -- changing -- moreover -- this example -- the whole -- transparency -- or it is translucent. Like [ if an example is shown more ] the example shown, for example in drawing 2, a touch panel 4 changes in piles the transparency sheet metal 16 with which the transparency sheet metal 10 which has two or more openings 12 was piled up, and the transparent electrode 18 was further formed on it at the inferior surface of tongue on the hard substrate 6 of transparency with which the transparent electrode 8 was formed in the top face. Transparent electrodes 8 and 18 may also have the case of the electrode of the shape of two or more stripe which intersects perpendicularly mutually, one electrodes 18, for example, a transparent electrode, may be two or more electrodes, and the electrode 8 of another side, for example, a transparent electrode, may be a common electrode. Since transparency sheet metal 16 is sheet metal, it has flexibility.

[0023] The hard substrate 6 is used downward for making vibration from the source 30 of excitation easy to tell the touch panel 4 whole, in order to maintain the monotonous configuration, since the touch panel 4 whole is floated from the display panel 2. This hard substrate 6 consists of for example, a transparency acrylic board, a transparency glass plate, etc. But the comparatively soft touch panel formed using the transparency sheet may be piled up on a substrate hard [ other ] (in the case of this example on the hard substrate of transparency). Moreover, instead of forming the hard substrate of touch panel 4 dedication, a display panel 2 may be made into a hard thing, and it may be made to serve as the above-mentioned hard substrate.

[0024] By this touch panel 4, that front face more specifically the front face of that transparency sheet metal 16 If switch section 4a is formed in the part of each opening 12 which is touch side 4b which people touch, and is near [ the ] the background and the part of the desired opening 12 is lightly pushed from the transparency sheet metal 16 side The transparency sheet metal 16 and the transparent electrode 18 of a part which were pushed bend, and the transparent electrode 18 contacts the lower transparent electrode 8 through opening 12, and is turned on electrically. however, the magnitude of each switch section 4a, a configuration, a location, a number, etc. may use two or more small switch section 4a as the one (namely, -- electric -- parallel connection -- carrying out) switch section collectively arbitrarily

[0025] In this example, although the periphery section of this touch panel 4 may be directly fixed to a case 20 again with reference to drawing 1, in order to carry out that it is easy to vibrate the touch panel 4 whole, a touch panel 4 is floated from a case 20, and that periphery section is supported from the case 20 through two or more elastic bodies 24. This elastic body 24 is attached near the four corners of a touch panel 4. Although plate-like flat spring like the example shown in drawing 1 is sufficient as each elastic body 24, if it is made into the flat spring of the shape of a corrugated plate like the example shown in drawing 4, it will become that it is much more easy to vibrate a touch panel 4. Moreover, coiled spring is sufficient as each elastic body 24, in addition rubber, sponge, etc. are sufficient as it.

[0026] In this example, the periphery section 22 of a case 20 has hung on the periphery section of a touch panel 4, and although this periphery section 22 and touch panel 4 may be contacted directly, in

order to carry out that it is easy to vibrate a touch panel 4, the small clearance 26 is formed by this example. When forming a clearance 26, the elastic body 42 which has waterproofing and a protection-against-dust function may be formed there like the example shown in drawing 5. This elastic body 42 is sponge, rubber membrane, etc. This thin switch 50 whole can be easily made into waterproofing and the dustproof structure, making vibration of a touch panel 4 easy, if the above elastic bodies 42 are formed, since a touch panel 4 has neither a hole nor a clearance and it has waterproofing and a protection-against-dust function from the first.

[0027] Between the periphery section of the above-mentioned touch panel 4, and a case 20, the source 30 of excitation which vibrates the touch panel 4 whole containing touch side 4b is formed in this example. But although it is touch side 4b that it is necessary to make it vibrate truly, since the front face of a touch panel 4 is touch side 4b as it is in this example, it is not indispensable to only carry out to vibrating the touch panel 4 whole, and to vibrate the touch panel 4 whole. Although \*\*\*\*\* [ the number of these sources 30 of excitation / one ], if it makes it plurality and it is distributed and arranged in the periphery section of a touch panel 4, they can vibrate the touch panel 4 whole more uniformly.

[0028] Each source 30 of excitation is a piezoelectric transducer as an example in this example. A piezoelectric transducer is a component which vibrates a piezo-electric substrate by impressing alternating voltage to inter-electrode [ which was prepared in both sides of a piezo-electric substrate ] as everyone knows. An electrostrictive actuator is one of those which have the almost same structure as this piezoelectric transducer, and it may be used for this source 30 of excitation.

[0029] Since it will become the rude thing [ GOTSUGOTSU / thing / the feel which gets across to a finger ] if not much low, and a finger will become ticklish if not much high, as for the frequency which vibrates a touch panel 4 by the source 30 of excitation, it is desirable to carry out within the limits of 50Hz - 150Hz, and especially its within the limits of 80Hz - 130Hz is desirable also among them. Also in other examples, it is the same.

[0030] An example of a drive circuit which drives each source 30 of excitation electrically is shown in drawing 3.

[0031] The touch panel 4 has the transparent electrode 8 of m lines, and the transparent electrode 18 of n train in this example (m and n are one or more integers), and is switch section 4a which each of those intersections mentioned above. Each of these transparent electrodes 8 and 18 are connected to the detector 52 while they are pulled out in order to connect with the circuit (illustration abbreviation) of the exterior which specifies switch section 4a to which press actuation was performed.

[0032] A detector 52 detects that at least one switch section 4a of a touch panel 4 was operated, and while the switch section 4a concerned is operated, it outputs the predetermined level S, for example, the detecting signal of a high level, all the time. This detector 52 can be carried out using the 1st OR circuit by which the transparent electrode 8 of 1-m lines was connected to the input section, the 2nd OR circuit by which the transparent electrode 18 of 1 - n train was connected to the input section, and the AND circuit which asks for AND of the output from both OR circuits etc., and can consist of well-known techniques.

[0033] The detecting signal S from this detector 52 is given to the alternating current oscillator 54. While answering this detecting signal S and giving it, the alternating current oscillator 54 is put in block in each source 30 of excitation, supplies alternating voltage, and drives them. Between this alternating current oscillator 54 and the source 30 of excitation, an amplifying circuit may be prepared if needed. Since the frequency of the output of this alternating current oscillator 54 and the frequency of vibration of the source 30 of excitation are mutually equal fundamentally, as mentioned above, as for the frequency of the output of this alternating current oscillator 54, it is desirable to carry out within the limits of 50Hz - 150Hz, and especially its within the limits of 80Hz - 130Hz is desirable [ a frequency ] also among them.

[0034] This detector 52 and the alternating current oscillator 54 may carry out containing in the case 20 mentioned above etc., may be attached to the thin switch 50 of this example, may be contained in the device of the other party to which this thin switch 50 is connected, without making it such, or may be constituted using a circuit, a microcomputer, etc. which were formed there. The same is said of the

detectors 92 and 108 mentioned later.

[0035] If one switch section 4a of the arbitration of a touch panel 4 will be pushed if actuation of the thin switch 50 shown in drawing 1 is explained, and it is made to turn on It is detected by the detector 52, a detecting signal S is outputted from there, according to it, alternating voltage is supplied to each source 30 of excitation from the alternating current oscillator 54, each source 30 of excitation vibrates, and the touch panel 4 whole which contains touch side 4b by it is vibrated. And it gets across to the finger of the person whom vibration of this touch panel 4 operated. Therefore, it can sense having operated switch section 4a with the operated finger. Consequently, sense of security can be given to the person who operated it.

[0036] If press actuation of switch section 4a of a touch panel 4 is stopped, the switch section 4a concerned is turned off by itself, it will be answered, the output of the detecting signal S from a detector 52 and the output of the alternating voltage from the alternating current oscillator 54 will stop, and vibration of a touch panel 4 will stop.

[0037] Thus, it is the finger of the person who operated it with this thin switch 50, and since what (it was made to turn on typically) switch section 4a of a request of a touch panel 4 was operated for can be sensed, it is the most natural and rational. Therefore, unlike the approach of changing the display of the display panel of the conventional example, when the operator has turned to width, also when it is a visually handicapped person, it can sense certainly. moreover, the approach of making the sound of the conventional example -- being different -- noisiness -- also when a location and an operator are persons hard of hearing, it can sense certainly. Moreover, it can be used convenient at all also in the location which will be troubled if a sound comes out.

[0038] Moreover, since the above-mentioned display panel with a switch using such a thin switch 50 can make between a touch panel 4 and display panels 2 approach and the contents of a display of a display panel 2 will be displayed by it immediately near the touch panel 4, in addition to the above effectiveness of the thin switch 50, the effectiveness that the contents of a display of a display panel 2 are very legible is also acquired.

[0039] Each source 30 of excitation is things other than the piezoelectric transducer mentioned above or an electrostrictive actuator, and may be constituted. Also in other examples mentioned later, it is the same.

[0040] For example, the source 30 of excitation may consist of an electromagnet 32 which wound the coil 36 around the iron core 34, and a permanent magnet 38 attached in the touch panel 4 so that a clearance might be opened in it and it might be countered like the example shown in drawing 4. Alternating current is supplied from the alternating current oscillator 54 mentioned above on this electromagnet 32. In the magnetic pole of an iron core 34, N and S occur by turns by it, the permanent magnet 38 which counters it can be attracted or repelled, and a touch panel 4 can be vibrated by it. The number of the magnetic poles of an iron core 34 one, and they should just make N pole or the south pole of a permanent magnet 38 counter it in that case. Although ferromagnetics, such as a griddle, may be used instead of a permanent magnet 38, since the direction which uses a permanent magnet 38 can also use the magnetism, exciting force becomes larger. If it puts in another way, the output of the alternating current oscillator 54 can be made small, and power-saving can be attained.

[0041] the electromagnetism which has the plunger by which the source 30 of excitation was connected to the touch panel 4, the coil which attracts it -- you may constitute from a solenoid. this electromagnetism -- alternating current is supplied from the alternating current oscillator 54 mentioned above in the solenoid. By it, a plunger can vibrate and a touch panel 4 can be vibrated.

[0042] The source 30 of excitation has attached the weight which carried out eccentricity to the revolving shaft, and may constitute it from a vibrating motor with which the motor itself vibrates. In that case, what is necessary is just to prepare DC power supply or the amplifying circuit which amplifies a detecting signal S instead of the alternating current oscillator 54 mentioned above. A touch panel 4 can be vibrated by contacting or attaching this vibrating motor in the touch panel 4, and rotating it.

[0043] In addition, in the case of the above-mentioned example, the touch panel 4 made it the thing of transparency, as it mentioned above in order to combine with the display panel 2 arranged downward,

but according to the contents of a display of a display panel 2 etc., it does not necessarily need to be transparent, may be translucent and, in short, just penetrates the light from the lower display panel 2. [0044] Moreover, since it is not necessary to be also able to use it, without piling up on a display panel 2, for example, to be independent separately [ a display panel 2 ], or to also use the thin switch 50 combining other devices etc., and to make the light from the lower display panel 2 penetrate in that case, the above-mentioned thin switch 50 does not need to be transparent or translucent, and even when it is opaque, it is good. [ of a touch panel 4 ] In that case, the need may be accepted for discernment of switch section 4a etc., and you may carry out filling in, stamping and sticking an alphabetic character, a notation, etc. on the front face of a touch panel 4 etc. Also in other examples mentioned later, it is the same.

[0045] By the way, the photoelectrical-type touch panel which is [ a thing / it ] intermittent or attenuates that the light which came out of the light emitting device goes into a photo detector besides the touch panel 4 of the above resistance film types, or the ultrasonic-type touch panel which is [ a thing / it ] intermittent or attenuates that the supersonic wave which came out of the ultrasonic oscillation component goes into a \*\*\*\* component is sufficient as a touch panel. It is there, next the example using a photoelectrical-type touch panel or an ultrasonic-type touch panel is explained. However, the same part as a previous example omits duplication explanation, and explains difference with a previous example to a subject.

[0046] Drawing 6 is the sectional view showing partially an example in case a touch panel 114 is a photoelectrical type, and since the part below a touch panel 114 is the same as that of a previous example, illustration is omitted here. In this example, one or more switch section 114a is formed near front [ of touch side 114b of a touch panel 114 ].

[0047] A touch panel 114 also refers to drawing 7, carries out phase opposite of two or more photo detectors 90 which change it into an electrical signal in response to two or more light emitting devices 84 which output light 86, and the light 86 concerned in all directions into the periphery section 22 of a case 20, is arranged, and is carrying out the configuration in which the matrix-like optical path 88 was formed to the space near the front face of the hard substrate 82. Near the intersection of two optical paths 88 is switch section 114a, respectively. The number of the optical paths 88 which carry out matrix arrangement is arbitrary at mxn (m and n are one or more integers).

[0048] The hard substrate 82 consists of transparency, a translucent glass plate, or an acrylic board. Each light emitting device 84 is LED, semiconductor laser, etc. Each photo detector 90 is photo diode, a photo transistor, etc. It is the same as that of the case of a previous example whether the elastic body which has waterproofing and a protection-against-dust function is prepared in whether a clearance is opened between this hard substrate 82 and the periphery section 22 of a case 20 and there.

[0049] Although the light 86 outputted from each light emitting device 84 is desirable since infrared light is not attached to the public notice, of course, the light is sufficient as it. Moreover, the method made to always emit light is sufficient as the method which makes each light emitting device 84 emit light, and the method (this is also called a sequential luminescence method or a scanning method) made to emit light in order using a microcomputer etc. is sufficient as it. This microcomputer etc. may be used also [ what / constitutes the detector 92 explained below ].

[0050] As this example shows to each photo detector 90 in every direction at drawing 7, a signal is answered from each photo detector 90. The function which outputs the position signal P with which the location (coordinate) of the intersection of an optical path 88 to which the quantity of light fell is detected, namely, switch section 114a to which actuation was performed is specified, and the location is expressed, The detector 92 which has the function which outputs the detecting signal S which detected and mentioned above that at least one switch section 114a was operated is connected. It is the same as that of the case of the example mentioned above after the alternating current oscillator 54, and explanation of the operation etc. is omitted.

[0051] The front face of the hard substrate 82 is touch side 114b which people touch, and it is made to vibrate in this example by the source 30 of excitation which mentioned above the hard substrate 82 whole which forms this touch side 114b. That is, if touch side 114b is touched with a finger, an optical

path 88 is interrupted with a finger and switch section 114a of arbitration is operated, it is detected by the detector 92, it is answered, with the alternating current oscillator 54, the source 30 of excitation will drive, the hard substrate 82 will vibrate, and it will get across to a finger. Therefore, it can sense having operated switch section 114a with the operated finger.

[0052] In addition, the hard substrate 82 may make that display panel 2 serve as the above-mentioned hard substrate, since the main functions form touch side 114b in this example, when the hard display panel 2 (refer to drawing 1) is arranged downward. That is, the hard substrate 82 is omitted and it is good also considering the front face of a display panel 2 as a touch side. In that case, what is necessary is just to vibrate a front face by the source 30 of excitation, even if there are few these display panels 2.

[0053] Drawing 8 is the sectional view showing partially an example in case a touch panel 124 is an ultrasonic type, and since the part below a touch panel 124 is the same as that of the case of a previous example, illustration is omitted here. In this example, one or more switch section 124a is formed in the front face of touch side 124b of a touch panel 124 itself.

[0054] This touch panel 124 is based on the same technical thought as the touch panel indicated by U.S. Pat. No. 5,177,327.

[0055] That is, this touch panel 124 also refers to drawing 9, carries out phase opposite of two or more \*\*\*\* components 106 which change it into an electrical signal in response to two or more oscillation components 96 with which a supersonic wave 100 is outputted, and the supersonic wave 100 concerned in all directions on the front face of the periphery section of the hard substrate 94, is arranged, and is carrying out the configuration in which the ultrasonic matrix-like path 102 was formed on the front face of the hard substrate 94. Near the intersection of two ultrasonic paths 102 is switch section 124a, respectively. In this case, since directivity is very high, there is usually no possibility of 100 supersonic wave that the supersonic wave 100 which spreads one ultrasonic path 102 may enter and interfere in the next ultrasonic path 102. The number of the ultrasonic paths 102 which carry out matrix arrangement is arbitrary at mxn (m and n are one or more integers).

[0056] The hard substrate 94 is transparency or a translucent glass substrate.

[0057] In this example, a supersonic wave 100 is a surface acoustic wave, the supersonic wave 100 from the oscillation component 96 is led to the front face of a substrate 94 via waveguide 98, and the supersonic wave 100 of the front face of a substrate 94 is led to the \*\*\*\* component 106 for it via waveguide 104. Each oscillation component 96 and each \*\*\*\* component 106 are piezoelectric transducers. These are dedicated to the space section in the periphery section 22 of a case 20 in this example. It is the same as that of the case of a previous example whether the elastic body which has waterproofing and a protection-against-dust function is prepared in whether a clearance is opened between the periphery section 22 of this case 20 and a substrate 94 and there.

[0058] As this example shows to each \*\*\*\* component 106 in every direction at drawing 9, a signal is answered from each \*\*\*\* component 106. The function which outputs the position signal P with which the location (coordinate) of the intersection of the ultrasonic path 102 which the supersonic wave 100 decreased is detected, namely, switch section 124a to which actuation was performed is specified, and the location is expressed, The detector 108 which has the function which outputs the detecting signal S which detected and mentioned above that at least one switch section 124a was operated is connected. It is the same as that of the case of the example mentioned above after the alternating current oscillator 54, and explanation of the operation etc. reduces a labor.

[0059] The front face of the hard substrate 94 is touch side 124b which people touch, and it is made to vibrate in this example by the source 30 of excitation which mentioned above the hard substrate 94 whole containing this touch side 124b. That is, if touch side 124b is touched with a finger, a supersonic wave 100 is absorbed with a finger and switch section 124a of arbitration is operated, it is detected by the detector 108, it is answered, with the alternating current oscillator 54, the source 30 of excitation will drive, the hard substrate 94 will vibrate, and it will get across to a finger. Therefore, it can sense having operated switch section 124a with the operated finger.

[0060] In addition, the distortion wave which spreads the interior of the hard substrate 94 may be used instead of the above surface acoustic waves as a supersonic wave 100. In that case, the oscillation

component 96 and the \*\*\*\* component 106 are attached in the end face in which the hard substrate 94 carries out phase opposite. This method is also called the inside guided wave form. In the case of this method, it is possible that one or more switch sections which were mentioned above 124a is formed near the flesh side of touch side 124b of the front face of the hard substrate 94.

[0061] Although each made the direction of excitation of the touch side by the source 30 of excitation the vertical direction of a touch side in the above-mentioned example, it is not limited to it, and the direction of other, for example, the direction along a touch side etc., is sufficient, and, in short, a touch side should just vibrate.

[0062] If the transparency sheet metal 132 which has a through hole 134 into the part corresponding to the switch section of those touch panels may be put on the front face of the all directions-type touch panel mentioned above like the example shown in drawing 10 and it is made such, since a finger can be positioned with few level differences produced into the part of a through hole 134, positioning of the finger to the switch section becomes easily and certain. The part which that becomes thin and has a level difference in this transparency sheet metal 132 although penetration has not been carried out instead of the through hole 134 may be prepared, and even if such, the same effectiveness as the above is acquired.

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[Translation done.]

**\* NOTICES \***

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

[Field of the Invention] This invention relates to the thin switch used for for example, FA (factory automation) device, an automatic vending machine, an automatic ticket vending machine, information machines and equipment, a home electrical-and-electric-equipment product, the actuation device of medical application, etc., and the display panel with a switch using it.

**[0002]**

[Description of the Prior Art] A touch panel is one of the typical things of a thin switch. If it summarizes, the touch panel has [ near / which people touch / the table of a touch side thru/or near the flesh side ] the one or more switch sections, pushes it in, and a stroke is about 0, namely, it can say it as the switch of the shape of whether it touches and a panel operational with extent pushed lightly.

[0003] The resistance film type which opened few tooth spaces for the up-and-down transparent electrode between \*\* transparency sheet metal, and was made to counter such a touch panel (this is also called a transparent electrode type.) There are a photoelectrical type which intercepts or attenuates with a finger etc. that the light which came out of the same \*\* light emitting device below goes into a photo detector, an ultrasonic type which intercepts or attenuates with a finger etc. that the supersonic wave which came out of \*\* supersonic-wave oscillation component goes into a \*\*\*\* component, other electrostatic-capacity types, etc.

[0004] Such a touch panel is used as a display panel with a switch by piling it as a thin switch up by independent [ its ] on the display panel which has an information-display function.

**[0005]**

[Problem(s) to be Solved by the Invention] the touch panel has the features that thin-shape-izing is very possible -- although kicked -- the above -- since the pushing stroke of the switch section was about 0, and since a feeling of a click cannot be taken out unlike the switch which has the usual switch mechanism, in [ any ] the method, surely the switch section operated -- \*\* (it made turn on typically) -- there is a problem that where of what is said cannot sense with a finger. Then, it does not know whether, surely the person who operated it operated the switch section, but he becomes uneasy.

[0006] In order to compensate this, when the switch section of a touch panel was operated conventionally, the approach of changing the display of the liquid crystal display combined with the touch panel, and the approach of making the sound of a buzzer etc. were used together.

[0007] However, by the approach of changing a display, when the operator has turned to width, when it is a visually handicapped person, it cannot check.

[0008] moreover -- the approach of making a sound -- noisiness -- when a location and an operator are persons hard of hearing, it cannot check. Moreover, in the location which will be troubled if a sound comes out, this sound becomes obstructive.

[0009] It is most natural to sense to have operated the switch section too with the finger of the person who operated it, and it is rational.

[0010] Then, this invention sets it as the main purpose to offer the thin switch which can sense having

operated that switch section with a finger, and the display panel with a switch using it, employing efficiently the features of a touch panel that thin-shape-izing is very possible.

[0011]

[Means for Solving the Problem] The thin switch of this invention is characterized by answering that have the one or more switch sections the table of a touch side thru/or near the flesh side, pushed it in, and at least one switch section of a touch panel operational with about 0 in a stroke and this touch panel was operated, and having an excitation means of the touch panel concerned to vibrate a touch side at least.

[0012] Moreover, the display panel with which the display panel with a switch of this invention has an information-display function, It is arranged near the upper part of this display panel, has the one or more switch sections the table of a touch side thru/or near the flesh side, and it is pushed in. Transparency operational with about 0 in a stroke, or a translucent touch panel, It is characterized by answering that at least one switch section of this touch panel was operated, and having an excitation means of the touch panel concerned to vibrate a touch side at least.

[0013] A touch side is a field which the man of a touch panel touches. It means that any near the flesh side of a touch side the front face of a touch side itself and near front [ of a touch side ] are sufficient the table of a touch side thru/or near the flesh side. Actuation of the switch section is meaning changing the condition of the switch section and making it turn on typically.

[0014] According to the above-mentioned thin switch, if the switch section of the touch panel is operated, it will be answered and it will get across to the finger of the person whom the touch side was vibrated at least and the vibration operated of the touch panel concerned with an excitation means. Therefore, it can sense having operated the switch section with a finger by vibration of a touch side.

[0015] Substantially, since the above-mentioned display panel with a switch is having structure which has arranged the above thin switches which used the touch panel near the upper part of a display panel, it can sense having operated the switch section of a touch panel according to the same operation as the above-mentioned thin switch with a finger by vibration of a touch side. And since between a touch panel and display panels can be made to approach and the contents of a display of a display panel will be displayed by it immediately near the touch panel, the contents of a display are very legible.

[0016]

[Embodiment of the Invention] Drawing 1 is the sectional view showing the example of the display panel with a switch using a thin switch equipped with the touch panel of a resistance film type. In this example, one or more switch section 4a is formed near the flesh side of touch side 4b of a touch panel 4.

[0017] The display panel with a switch of this example is making it structure which has arranged the thin switch 50 near the upper part of this display panel 2 while arranging the display panel 2 which has an information-display function at the pars basilaris ossis occipitalis within a case 20.

[0018] A display panel 2 does not ask whether the information to display is a constant, or it is adjustable information, or is spontaneous light and whether it has the back light etc. that what is necessary is just to have the information-display function in short. For example, although this display panel 2 is a liquid crystal display typically, EL (electroluminescent) display, a plasma display, CRT, an LED array, the thing that combined the emitter which illuminates the imprinting plate and liquid crystal shutter which display information, and it, and the reflecting plate, a mere sheet, a mere plate which indicated information further, etc. are sufficient as it. a display panel 2 -- for example, a sheet, a plate, etc. -- like - \*\*\*\* -- although it is thin, a case may attach it in the rear face of a touch panel 4.

[0019] What is necessary is just to select the structure of a case 20 suitably according to the class of display panel 2 etc. Moreover, it is good even if another in the case for thin switch 50, and the case for display-panel 2.

[0020] In this example, viewing-area 2a which displays the contents chosen near the lower part of each switch section 4a of the touch panel 4 which constitutes the thin switch 50 by actuation of the switch section 4a concerned is formed in the display panel 2, respectively. Therefore, selection and actuation of desired switch section 4a become easy.

[0021] In this example, the thin switch 50 answered that at least one switch section 4a of the touch panel

4 of a resistance film type and this touch panel 4 was operated, and is equipped with the source 30 of excitation which constitutes an excitation means to vibrate the touch panel 4 whole containing surface touch side 4b.

[0022] one or more switch section 4a turned on by pushing this touch panel 4 by about 0 namely, a stroke -- lightly from the outside near the front face of a hard substrate -- preparing -- changing -- moreover -- this example -- the whole -- transparency -- or it is translucent. Like [ if an example is shown more ] the example shown, for example in drawing 2, a touch panel 4 changes in piles the transparency sheet metal 16 with which the transparency sheet metal 10 which has two or more openings 12 was piled up, and the transparent electrode 18 was further formed on it at the inferior surface of tongue on the hard substrate 6 of transparency with which the transparent electrode 8 was formed in the top face. Transparent electrodes 8 and 18 may also have the case of the electrode of the shape of two or more stripe which intersects perpendicularly mutually, one electrodes 18, for example, a transparent electrode, may be two or more electrodes, and the electrode 8 of another side, for example, a transparent electrode, may be a common electrode. Since transparency sheet metal 16 is sheet metal, it has flexibility.

[0023] The hard substrate 6 is used downward for making vibration from the source 30 of excitation easy to tell the touch panel 4 whole, in order to maintain the monotonous configuration, since the touch panel 4 whole is floated from the display panel 2. This hard substrate 6 consists of for example, a transparency acrylic board, a transparency glass plate, etc. But the comparatively soft touch panel formed using the transparency sheet may be piled up on a substrate hard [ other ] (in the case of this example on the hard substrate of transparency). Moreover, instead of forming the hard substrate of touch panel 4 dedication, a display panel 2 may be made into a hard thing, and it may be made to serve as the above-mentioned hard substrate.

[0024] By this touch panel 4, that front face more specifically the front face of that transparency sheet metal 16 If switch section 4a is formed in the part of each opening 12 which is touch side 4b which people touch, and is near [ the ] the background and the part of the desired opening 12 is lightly pushed from the transparency sheet metal 16 side The transparency sheet metal 16 and the transparent electrode 18 of a part which were pushed bend, and the transparent electrode 18 contacts the lower transparent electrode 8 through opening 12, and is turned on electrically. however, the magnitude of each switch section 4a, a configuration, a location, a number, etc. may use two or more small switch section 4a as the one (namely, -- electric -- parallel connection -- carrying out) switch section collectively arbitrarily

[0025] In this example, although the periphery section of this touch panel 4 may be directly fixed to a case 20 again with reference to drawing 1, in order to carry out that it is easy to vibrate the touch panel 4 whole, a touch panel 4 is floated from a case 20, and that periphery section is supported from the case 20 through two or more elastic bodies 24. This elastic body 24 is attached near the four corners of a touch panel 4. Although plate-like flat spring like the example shown in drawing 1 is sufficient as each elastic body 24, if it is made into the flat spring of the shape of a corrugated plate like the example shown in drawing 4, it will become that it is much more easy to vibrate a touch panel 4. Moreover, coiled spring is sufficient as each elastic body 24, in addition rubber, sponge, etc. are sufficient as it.

[0026] In this example, the periphery section 22 of a case 20 has hung on the periphery section of a touch panel 4, and although this periphery section 22 and touch panel 4 may be contacted directly, in order to carry out that it is easy to vibrate a touch panel 4, the small clearance 26 is formed by this example. When forming a clearance 26, the elastic body 42 which has waterproofing and a protection-against-dust function may be formed there like the example shown in drawing 5. This elastic body 42 is sponge, rubber membrane, etc. This thin switch 50 whole can be easily made into waterproofing and the dustproof structure, making vibration of a touch panel 4 easy, if the above elastic bodies 42 are formed, since a touch panel 4 has neither a hole nor a clearance and it has waterproofing and a protection-against-dust function from the first.

[0027] Between the periphery section of the above-mentioned touch panel 4, and a case 20, the source 30 of excitation which vibrates the touch panel 4 whole containing touch side 4b is formed in this example. But although it is touch side 4b that it is necessary to make it vibrate truly, since the front face

of a touch panel 4 is touch side 4b as it is in this example, it is not indispensable to only carry out to vibrating the touch panel 4 whole, and to vibrate the touch panel 4 whole. Although \*\*\*\*\* [ the number of these sources 30 of excitation / one ], if it makes it plurality and it is distributed and arranged in the periphery section of a touch panel 4, they can vibrate the touch panel 4 whole more uniformly.

[0028] Each source 30 of excitation is a piezoelectric transducer as an example in this example. A piezoelectric transducer is a component which vibrates a piezo-electric substrate by impressing alternating voltage to inter-electrode [ which was prepared in both sides of a piezo-electric substrate ] as everyone knows. An electrostrictive actuator is one of those which have the almost same structure as this piezoelectric transducer, and it may be used for this source 30 of excitation.

[0029] Since it will become the rude thing [ GOTOTSUGOTSU / thing / the feel which gets across to a finger ] if not much low, and a finger will become ticklish if not much high, as for the frequency which vibrates a touch panel 4 by the source 30 of excitation, it is desirable to carry out within the limits of 50Hz - 150Hz, and especially its within the limits of 80Hz - 130Hz is desirable also among them. Also in other examples, it is the same.

[0030] An example of a drive circuit which drives each source 30 of excitation electrically is shown in drawing 3.

[0031] The touch panel 4 has the transparent electrode 8 of m lines, and the transparent electrode 18 of n train in this example (m and n are one or more integers), and is switch section 4a which each of those intersections mentioned above. Each of these transparent electrodes 8 and 18 are connected to the detector 52 while they are pulled out in order to connect with the circuit (illustration abbreviation) of the exterior which specifies switch section 4a to which press actuation was performed.

[0032] A detector 52 detects that at least one switch section 4a of a touch panel 4 was operated, and while the switch section 4a concerned is operated, it outputs the predetermined level S, for example, the detecting signal of a high level, all the time. This detector 52 can be carried out using the 1st OR circuit by which the transparent electrode 8 of 1-m lines was connected to the input section, the 2nd OR circuit by which the transparent electrode 18 of 1 - n train was connected to the input section, and the AND circuit which asks for ANDO of the output from both OR circuits etc., and can consist of well-known techniques.

[0033] The detecting signal S from this detector 52 is given to the alternating current oscillator 54. While answering this detecting signal S and giving it, the alternating current oscillator 54 is put in block in each source 30 of excitation, supplies alternating voltage, and drives them. Between this alternating current oscillator 54 and the source 30 of excitation, an amplifying circuit may be prepared if needed. Since the frequency of the output of this alternating current oscillator 54 and the frequency of vibration of the source 30 of excitation are mutually equal fundamentally, as mentioned above, as for the frequency of the output of this alternating current oscillator 54, it is desirable to carry out within the limits of 50Hz - 150Hz, and especially its within the limits of 80Hz - 130Hz is desirable [ a frequency ] also among them.

[0034] This detector 52 and the alternating current oscillator 54 may carry out containing in the case 20 mentioned above etc., may be attached to the thin switch 50 of this example, may be contained in the device of the other party to which this thin switch 50 is connected, without making it such, or may be constituted using a circuit, a microcomputer, etc. which were formed there. The same is said of the detectors 92 and 108 mentioned later.

[0035] If one switch section 4a of the arbitration of a touch panel 4 will be pushed if actuation of the thin switch 50 shown in drawing 1 is explained, and it is made to turn on It is detected by the detector 52, a detecting signal S is outputted from there, according to it, alternating voltage is supplied to each source 30 of excitation from the alternating current oscillator 54, each source 30 of excitation vibrates, and the touch panel 4 whole which contains touch side 4b by it is vibrated. And it gets across to the finger of the person whom vibration of this touch panel 4 operated. Therefore, it can sense having operated switch section 4a with the operated finger. Consequently, sense of security can be given to the person who operated it.

[0036] If press actuation of switch section 4a of a touch panel 4 is stopped, the switch section 4a

concerned is turned off by itself, it will be answered, the output of the detecting signal S from a detector 52 and the output of the alternating voltage from the alternating current oscillator 54 will stop, and vibration of a touch panel 4 will stop.

[0037] Thus, it is the finger of the person who operated it with this thin switch 50, and since what (it was made to turn on typically) switch section 4a of a request of a touch panel 4 was operated for can be sensed, it is the most natural and rational. Therefore, unlike the approach of changing the display of the display panel of the conventional example, when the operator has turned to width, also when it is a visually handicapped person, it can sense certainly. moreover, the approach of making the sound of the conventional example -- being different -- noisiness -- also when a location and an operator are persons hard of hearing, it can sense certainly. Moreover, it can be used convenient at all also in the location which will be troubled if a sound comes out.

[0038] Moreover, since the above-mentioned display panel with a switch using such a thin switch 50 can make between a touch panel 4 and display panels 2 approach and the contents of a display of a display panel 2 will be displayed by it immediately near the touch panel 4, in addition to the above effectiveness of the thin switch 50, the effectiveness that the contents of a display of a display panel 2 are very legible is also acquired.

[0039] Each source 30 of excitation is things other than the piezoelectric transducer mentioned above or an electrostrictive actuator, and may be constituted. Also in other examples mentioned later, it is the same.

[0040] For example, the source 30 of excitation may consist of an electromagnet 32 which wound the coil 36 around the iron core 34, and a permanent magnet 38 attached in the touch panel 4 so that a clearance might be opened in it and it might be countered like the example shown in drawing 4. Alternating current is supplied from the alternating current oscillator 54 mentioned above on this electromagnet 32. In the magnetic pole of an iron core 34, N and S occur by turns by it, the permanent magnet 38 which counters it can be attracted or repelled, and a touch panel 4 can be vibrated by it. The number of the magnetic poles of an iron core 34 one, and they should just make N pole or the south pole of a permanent magnet 38 counter it in that case. Although ferromagnetics, such as a griddle, may be used instead of a permanent magnet 38, since the direction which uses a permanent magnet 38 can also use the magnetism, exciting force becomes larger. If it puts in another way, the output of the alternating current oscillator 54 can be made small, and power-saving can be attained.

[0041] the electromagnetism which has the plunger by which the source 30 of excitation was connected to the touch panel 4, the coil which attracts it -- you may constitute from a solenoid. this electromagnetism -- alternating current is supplied from the alternating current oscillator 54 mentioned above in the solenoid. By it, a plunger can vibrate and a touch panel 4 can be vibrated.

[0042] The source 30 of excitation has attached the weight which carried out eccentricity to the revolving shaft, and may constitute it from a vibrating motor with which the motor itself vibrates. In that case, what is necessary is just to prepare DC power supply or the amplifying circuit which amplifies a detecting signal S instead of the alternating current oscillator 54 mentioned above. A touch panel 4 can be vibrated by contacting or attaching this vibrating motor in the touch panel 4, and rotating it.

[0043] In addition, in the case of the above-mentioned example, the touch panel 4 made it the thing of transparency, as it mentioned above in order to combine with the display panel 2 arranged downward, but according to the contents of a display of a display panel 2 etc., it does not necessarily need to be transparent, may be translucent and, in short, just penetrates the light from the lower display panel 2.

[0044] Moreover, since it is not necessary to be also able to use it, without piling up on a display panel 2, for example, to be independent separately [ a display panel 2 ], or to also use the thin switch 50 combining other devices etc., and to make the light from the lower display panel 2 penetrate in that case, the above-mentioned thin switch 50 does not need to be transparent or translucent, and even when it is opaque, it is good. [ of a touch panel 4 ] In that case, the need may be accepted for discernment of switch section 4a etc., and you may carry out filling in, stamping and sticking an alphabetic character, a notation, etc. on the front face of a touch panel 4 etc. Also in other examples mentioned later, it is the same.

[0045] By the way, the photoelectrical-type touch panel which is [ a thing / it ] intermittent or attenuates that the light which came out of the light emitting device goes into a photo detector besides the touch panel 4 of the above resistance film types, or the ultrasonic-type touch panel which is [ a thing / it ] intermittent or attenuates that the supersonic wave which came out of the ultrasonic oscillation component goes into a \*\*\*\* component is sufficient as a touch panel. It is there; next the example using a photoelectrical-type touch panel or an ultrasonic-type touch panel is explained. However, the same part as a previous example omits duplication explanation, and explains difference with a previous example to a subject.

[0046] Drawing 6 is the sectional view showing partially an example in case a touch panel 114 is a photoelectrical type, and since the part below a touch panel 114 is the same as that of a previous example, illustration is omitted here. In this example, one or more switch section 114a is formed near front [ of touch side 114b of a touch panel 114 ].

[0047] A touch panel 114 also refers to drawing 7, carries out phase opposite of two or more photo detectors 90 which change it into an electrical signal in response to two or more light emitting devices 84 which output light 86, and the light 86 concerned in all directions into the periphery section 22 of a case 20, is arranged, and is carrying out the configuration in which the matrix-like optical path 88 was formed to the space near the front face of the hard substrate 82. Near the intersection of two optical paths 88 is switch section 114a, respectively. The number of the optical paths 88 which carry out matrix arrangement is arbitrary at mxn (m and n are one or more integers).

[0048] The hard substrate 82 consists of transparency, a translucent glass plate, or an acrylic board. Each light emitting device 84 is LED, semiconductor laser, etc. Each photo detector 90 is photo diode, a photo transistor, etc. It is the same as that of the case of a previous example whether the elastic body which has waterproofing and a protection-against-dust function is prepared in whether a clearance is opened between this hard substrate 82 and the periphery section 22 of a case 20 and there.

[0049] Although the light 86 outputted from each light emitting device 84 is desirable since infrared light is not attached to the public notice, of course, the light is sufficient as it. Moreover, the method made to always emit light is sufficient as the method which makes each light emitting device 84 emit light, and the method (this is also called a sequential luminescence method or a scanning method) made to emit light in order using a microcomputer etc. is sufficient as it. This microcomputer etc. may be used also [ what / constitutes the detector 92 explained below ].

[0050] As this example shows to each photo detector 90 in every direction at drawing 7, a signal is answered from each photo detector 90. The function which outputs the position signal P with which the location (coordinate) of the intersection of an optical path 88 to which the quantity of light fell is detected, namely, switch section 114a to which actuation was performed is specified, and the location is expressed, The detector 92 which has the function which outputs the detecting signal S which detected and mentioned above that at least one switch section 114a was operated is connected. It is the same as that of the case of the example mentioned above after the alternating current oscillator 54, and explanation of the operation etc. is omitted.

[0051] The front face of the hard substrate 82 is touch side 114b which people touch, and it is made to vibrate in this example by the source 30 of excitation which mentioned above the hard substrate 82 whole which forms this touch side 114b. That is, if touch side 114b is touched with a finger, an optical path 88 is interrupted with a finger and switch section 114a of arbitration is operated, it is detected by the detector 92, it is answered, with the alternating current oscillator 54, the source 30 of excitation will drive, the hard substrate 82 will vibrate, and it will get across to a finger. Therefore, it can sense having operated switch section 114a with the operated finger.

[0052] In addition, the hard substrate 82 may make that display panel 2 serve as the above-mentioned hard substrate, since the main functions form touch side 114b in this example, when the hard display panel 2 (refer to drawing 1) is arranged downward. That is, the hard substrate 82 is omitted and it is good also considering the front face of a display panel 2 as a touch side. In that case, what is necessary is just to vibrate a front face by the source 30 of excitation, even if there are few these display panels 2.

[0053] Drawing 8 is the sectional view showing partially an example in case a touch panel 124 is an

ultrasonic type, and since the part below a touch panel 124 is the same as that of the case of a previous example, illustration is omitted here. In this example, one or more switch section 124a is formed in the front face of touch side 124b of a touch panel 124 itself.

[0054] This touch panel 124 is based on the same technical thought as the touch panel indicated by U.S. Pat. No. 5,177,327.

[0055] That is, this touch panel 124 also refers to drawing 9, carries out phase opposite of two or more \*\*\* components 106 which change it into an electrical signal in response to two or more oscillation components 96 with which a supersonic wave 100 is outputted, and the supersonic wave 100 concerned in all directions on the front face of the periphery section of the hard substrate 94, is arranged, and is carrying out the configuration in which the ultrasonic matrix-like path 102 was formed on the front face of the hard substrate 94. Near the intersection of two ultrasonic paths 102 is switch section 124a, respectively. In this case, since directivity is very high, there is usually no possibility of 100 supersonic wave that the supersonic wave 100 which spreads one ultrasonic path 102 may enter and interfere in the next ultrasonic path 102. The number of the ultrasonic paths 102 which carry out matrix arrangement is arbitrary at mxn (m and n are one or more integers).

[0056] The hard substrate 94 is transparency or a translucent glass substrate.

[0057] In this example, a supersonic wave 100 is a surface acoustic wave, the supersonic wave 100 from the oscillation component 96 is led to the front face of a substrate 94 via waveguide 98, and the supersonic wave 100 of the front face of a substrate 94 is led to the \*\*\* component 106 for it via waveguide 104. Each oscillation component 96 and each \*\*\* component 106 are piezoelectric transducers. These are dedicated to the space section in the periphery section 22 of a case 20 in this example. It is the same as that of the case of a previous example whether the elastic body which has waterproofing and a protection-against-dust function is prepared in whether a clearance is opened between the periphery section 22 of this case 20 and a substrate 94 and there.

[0058] As this example shows to each \*\*\* component 106 in every direction at drawing 9, a signal is answered from each \*\*\* component 106. The function which outputs the position signal P with which the location (coordinate) of the intersection of the ultrasonic path 102 which the supersonic wave 100 decreased is detected, namely, switch section 124a to which actuation was performed is specified, and the location is expressed, The detector 108 which has the function which outputs the detecting signal S which detected and mentioned above that at least one switch section 124a was operated is connected. It is the same as that of the case of the example mentioned above after the alternating current oscillator 54, and explanation of the operation etc. reduces a labor.

[0059] The front face of the hard substrate 94 is touch side 124b which people touch, and it is made to vibrate in this example by the source 30 of excitation which mentioned above the hard substrate 94 whole containing this touch side 124b. That is, if touch side 124b is touched with a finger, a supersonic wave 100 is absorbed with a finger and switch section 124a of arbitration is operated, it is detected by the detector 108, it is answered, with the alternating current oscillator 54, the source 30 of excitation will drive, the hard substrate 94 will vibrate, and it will get across to a finger. Therefore, it can sense having operated switch section 124a with the operated finger.

[0060] In addition, the distortional wave which spreads the interior of the hard substrate 94 may be used instead of the above surface acoustic waves as a supersonic wave 100. In that case, the oscillation component 96 and the \*\*\* component 106 are attached in the end face in which the hard substrate 94 carries out phase opposite. This method is also called the inside guided wave form. In the case of this method, it is possible that one or more switch sections which were mentioned above 124a is formed near the flesh side of touch side 124b of the front face of the hard substrate 94.

[0061] Although each made the direction of excitation of the touch side by the source 30 of excitation the vertical direction of a touch side in the above-mentioned example, it is not limited to it, and the direction of other, for example, the direction along a touch side etc., is sufficient, and, in short, a touch side should just vibrate.

[0062] If the transparency sheet metal 132 which has a through hole 134 into the part corresponding to the switch section of those touch panels may be put on the front face of the all directions-type touch

panel mentioned above like the example shown in drawing 10 and it is made such, since a finger can be positioned with few level differences produced into the part of a through hole 134, positioning of the finger to the switch section becomes easily and certain. The part which that becomes thin and has a level difference in this transparency sheet metal 132 although penetration has not been carried out instead of the through hole 134 may be prepared, and even if such, the same effectiveness as the above is acquired.

[0063]

[Effect of the Invention] Since this invention is constituted as above-mentioned, it does the following effectiveness so.

[0064] According to the thin switch according to claim 1, since the above excitation means were combined with the touch panel, it can sense having operated the switch section of a touch panel with a finger by vibration of the touch side of a touch panel. That is, it can sense having operated the switch section with a finger, employing efficiently the features of a touch panel that thin-shape-izing is very possible. Consequently, sense of security can be given to the person who operated it.

[0065] Thus, since it can sense having operated the switch section of a touch panel with the finger of the person who operated it according to this thin switch, it is the most natural and rational. Therefore, unlike the approach of changing the display of the display panel of the conventional example, when the operator has turned to width, also when it is a visually handicapped person, it can sense certainly. moreover, the approach of making the sound of the conventional example -- being different -- noisiness -- also when a location and an operator are persons hard of hearing, it can sense certainly. Moreover, it can be used convenient at all also in the location which will be troubled if a sound comes out.

[0066] Since the display panel with a switch according to claim 2 is having structure which has arranged the thin switch [ like ] according to claim 1 which used the touch panel near the upper part of a display panel, it can sense having operated the switch section of a touch panel with a finger by vibration of a touch side. Therefore, the same effectiveness as the thin switch of being able to give sense of security to the person who operated it according to claim 1 is done so.

[0067] And since between a touch panel and display panels can be made to approach and the contents of a display of a display panel will be displayed by it immediately near the touch panel, the effectiveness that the contents of a display are very legible also does so.

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[Translation done.]

**\* NOTICES \***

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2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The thin switch characterized by answering that have the one or more switch sections the table of a touch side thru/or near the flesh side, pushed it in, and at least one switch section of a touch panel operational with about 0 in a stroke and this touch panel was operated, and having an excitation means of the touch panel concerned to vibrate a touch side at least.

[Claim 2] It is arranged near the upper part of the display panel which has an information-display function, and this display panel. It has the one or more switch sections the table of a touch side thru/or near the flesh side, and it is pushed in. Transparency operational with about 0 in a stroke, or a translucent touch panel, The display panel with a switch characterized by answering that at least one switch section of this touch panel was operated, and having an excitation means of the touch panel concerned to vibrate a touch side at least.

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[Translation done.]

## \* NOTICES \*

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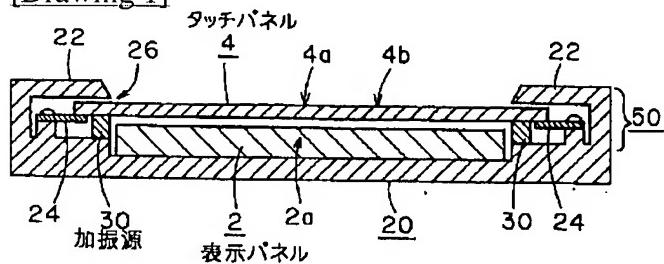
1. This document has been translated by computer. So the translation may not reflect the original precisely.
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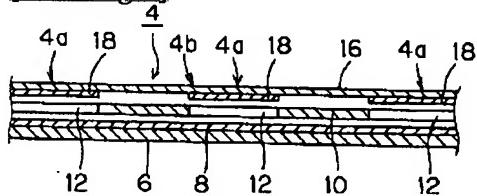
## DRAWINGS

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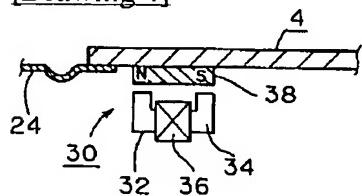
[Drawing 1]



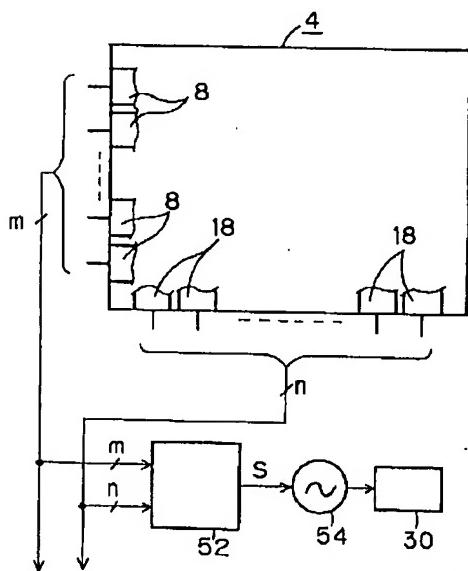
[Drawing 2]



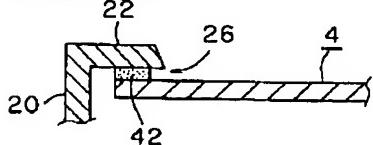
[Drawing 4]



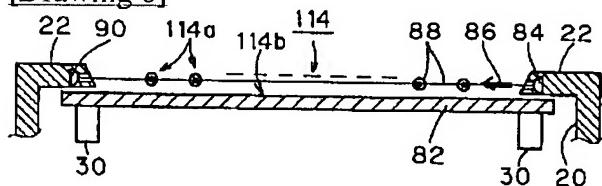
[Drawing 3]



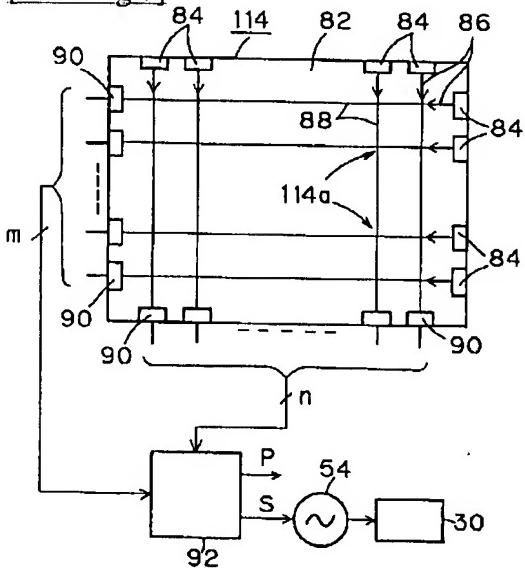
[Drawing 5]



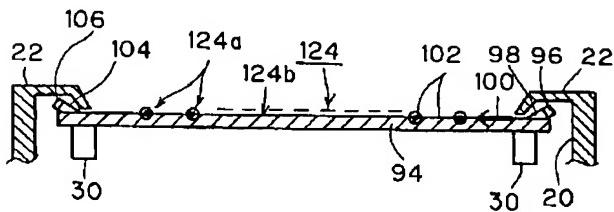
[Drawing 6]



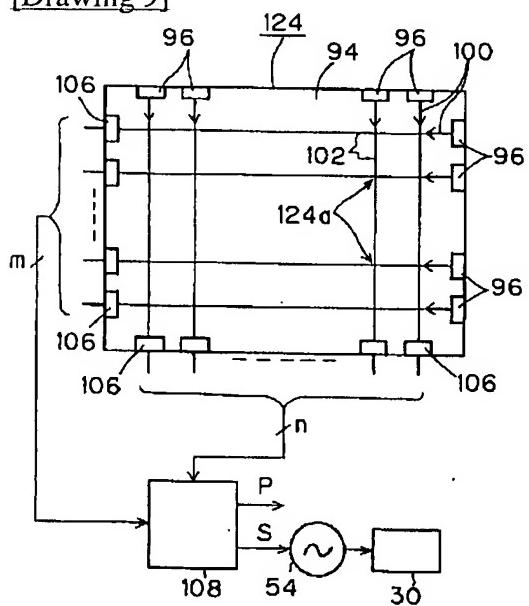
[Drawing 7]



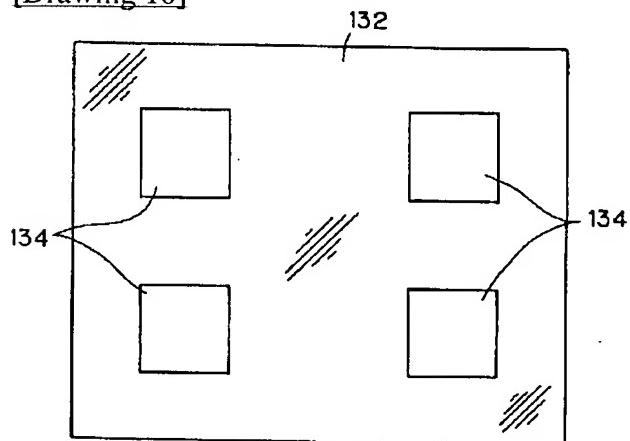
[Drawing 8]



[Drawing 9]



[Drawing 10]



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[Translation done.]